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Cost Stickiness and Financial Analysts' Information Environment

: An Evidence from the Korean Market

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〈 Abstract 〉

[Purpose] This study investigates whether the decline in the forecast accuracy and coverage for sticky firms (Weiss 2010) is due to the analysts' information environment such as the decrease in reliance on private information.

[Methodology] We used Weiss (2010)'s firm-level cost stickiness and Barron et al. (1998)'s precision of analysts' public and private information, and the consensus, the degree to which analysts rely on public or private information.

[Findings] First, we found that sticky cost behavior decreases both public and private information. Besides, sticky cost behavior decreases private information to a more significant extent than public information. Second, we found that forecast errors are reduced for the sticky firms when analysts increase their reliance on private information. Finally, sticky cost behavior increases analysts' reliance on private information in the next period.

[Implications] We believe that our study contributes to the literature because not many studies have investigated the influence of asymmetric cost structure on the analysts' information set, private and public information. We believe that this study contributes to the understanding of cost stickiness in that we showed the sticky cost's impact on the information intermediation activities of individual analysts, especially we confirmed that analysts' private information plays an important role in improving the accuracy of analysts' earnings forecast for firms with cost stickiness.

Key word: Analyst information environment, Cost stickiness, Earnings forecasts accuracy, Private information, Public information

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기업의 원가행태가 재무분석가의 정보환경에 미치는 영향

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< 국문초록 >

[연구목적] 본 연구에서는 원가하방경직적인 기업에 대한 재무분석가의 예측정확성과 커버리지 감소(Weiss 2010)가 재무분석가의 예측 정보환경에 기인한 것인지 살펴보았다.

[연구방법] 본 연구는 Weiss(2010)의 기업 단위 원가하방경직성과 Barron et al.(1998)의 재무분석가의 공적 및 사적정보 정확성 그리고 공적 또는 사적정보 의존도(consensus) 변수를 이용하였다.

[연구결과] 첫째, 원가하방경직성이 커질수록 재무분석가의 공적정보와 사적정보가 모두 감소하는 것으로 나타났다. 또한 공적정보와 사적정보 중에서는 사적정보가 더 크게 감소하였다. 두 번째로, 원가하방경직적인 기업에서 재무분석가의 사적정보에 대한 의존도가 높아지면 재무분석가의 이익예측오차가 감소하였다. 마지막으로, 원가하방경직적인 기업에 대해 재무분석가는 차기에서 사적정보 활용도를 증가시키는 것으로 나타났다.

[연구의 시사점] 원가하방경직성이 공적정보나 사적정보로 구성된 재무분석가의 정보환경에 미치는 영향에 관한 연구는 아직까지 드문 편이라는 면에서 본 연구는 선행연구에 대해 추가적인 기여점이 있다고 보여진다. 본 연구는 원가하방경직성이 재무분석가의 정보중개 활동에 미치는 영향을 보여주었고, 특히 원가하방경직성이 높은 환경에서 사적 정보가 재무분석가의 분석에서 가지는 중요성이 크다는 것을 보였다는 면에서 원가하방경직성에 대한 이해의 폭을 넓히는 데 기여할 수 있으리라 여겨진다.

주제어: 재무분석가 정보환경, 원가행태, 원가하방경직성, 이익예측정확성, 사적정보, 공적정보

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Ⅰ. Introduction

Forecasting failure can impair financial analysts' reputations and may even threaten their job securities (Stickel 1992; Mikhail et al. 1999). Negative earnings surprises not only impact the assets of analysts' clients but also may deteriorate the relationship between analysts and management, because negative earnings surprises damage managers' wealth and reputations as well (Richardson et al. 2004; Ke and Yu 2006). Therefore, financial analysts have an incentive to acquire more information to minimize the possibility of forecasting failures. Prior studies have documented that analysts use various sources of information to improve the accuracy of their earnings forecasts (Chen and Matsumoto 2006; Ke and Yu 2006; Stoles 2014). Analysts utilize financial statements as the primary input of their decision models to estimate future earnings. Other information available to financial analysts includes public information such as industry trends, stock market conditions, and macroeconomic factors, as well as private information obtained from managers through personal channels.

While forecasting future earnings, financial analysts need to know estimated costs. In other words, analyzing cost behavior is an important part of estimating earnings. According to Anderson et al. (2003), some costs are "sticky" as the Selling, General, and Administrative expenses (hereafter, SGA) increase more when sales increase than they decrease when sales decrease by an equivalent amount. Banker and Chen (2006) suggest that cost behavior explains a considerable portion of the analysts' advantage in earnings prediction. Extending Banker and Chen (2006)'s idea, Weiss (2010) reports that firms with stickier cost behavior reduce the accuracy of analysts' earnings forecasts more than firms with anti-sticky cost behavior. Because firms with stickier cost behavior increase the variability of the earnings distribution, these firms cause more big earnings surprises than firms with less sticky cost behavior. Based on the findings of Banker and Chen (2006) and Weiss (2010), we expect that stickier cost behavior affects the information environments surrounding analysts, as reflected in the precision of the analysts' information set.

This study investigates the effects of the sticky cost behavior on the information intermediation activities of individual analysts using Korean data. We utilized the firm-level cost stickiness based on Weiss (2010). We also used the measures introduced by Barron et al. (1998) to capture the average precision of analysts' public and private information and to measure analysts' consensus, the degree to which analysts rely on private versus public information.

Our research questions in this study are as follows. First, Weiss (2010) reports that firms with stickier cost behavior have less accurate analysts' earnings forecasts and lower analyst coverage than those with anti-sticky cost behavior. We examined whether the decline in the analysts' information environment of firms with sticky cost behavior is due to the decrease in the precision of analysts' public information, private information, or both.

Second, prior studies have documented that analysts improve the accuracy of their earnings forecasts by acquiring private information from management (Ke and Yu 2006; Chen and Matsumoto 2006). We examined whether earnings forecast errors decrease in firms with stickier cost behavior when analysts acquire more private information.

Third, significant earnings surprises impair financial analysts' reputations and job security (Stickel 1992; Mikhail et al. 1999); therefore, financial analysts have incentives to acquire private information to reduce forecast errors. We investigated whether sticky cost behavior prompts analysts to obtain more private information to avoid forecasting failures in the next period.

After analyzing non-financial Korean public firms between 2001 and 2013, our empirical results revealed the following. First, we found that sticky cost behavior decreases both analysts' public information and private information. Also, sticky cost behavior reduces private information to a greater extent than public information. Test results explain why analysts' earnings forecasts are less accurate for firms with stickier cost behavior.

Second, test results showed that earnings forecast errors decrease for firms with cost stickiness when analysts increase their reliance on private information. Because firms with stickier cost behavior cause more big earnings surprises than firms with less sticky cost behavior (Banker and Chen 2006),[1] analysts could improve the accuracy of their earnings forecasts when they acquire more private information.

Third, we discovered that stickier cost behavior increases analysts' reliance on private information in the next period, implying that analysts need more private information to analyze firms with sticker cost behavior. Robustness tests employing Homburg and Nasev (2008)'s cost stickiness measure showed consistent results with our main findings based on the Weiss (2010) model.

We believe that our study contributes to the literature because not many studies have investigated the influence of asymmetric cost structure on the analysts' information set,

1) Banker and Chen (2006) report that firms with stickier cost behavior show increased variability of the earnings distribution.

private and public information. The remainder of this paper organizes as follows. In Section Ⅱ, we reviewed the previous literature and developed our hypotheses. Section Ⅲ describes the sample and the research design, and Section Ⅳ presents the empirical results. Our robustness test results are in section Ⅴ. Finally, we provided our conclusion in section Ⅵ.

Ⅱ. Literature review and hypothesis development

2.1 Sticky cost behavior and financial analysts' information environment

When an analyst prepares an estimated income statement, she needs to know not only future sales but also other accounts, including costs that collectively affect net income. As the accuracy of future cost estimation is essential for correct earnings forecasts, analysts who understand a firm's cost behavior can achieve a competitive advantage. Unfortunately, there have not been many studies about the relationship between firms' cost behavior and the properties of individual analysts' earnings forecasts.

Because the traditional cost model is based on the "black box" view (Garrison et al. 2015), the model assumed a linear relationship between cost drivers and costs, which means that costs change proportionately to unit activity changes (Noreen and Soderstrom 1997). Anderson et al. (2003) provided a different view in which costs were asymmetric, not decreased or increased proportionally. According to them, SGA costs are "sticky" if the costs decrease at sales decrease is less than the cost increase at the sales increase. Conversely, the cost will be "anti-sticky" if costs decrease at sales decrease is more than the opposite case. Subsequent studies on different countries and multiple industries confirmed the existence of cost stickiness (Calleja et al. 2006; Anderson and Lanen 2007; Balakrishnan et al. 2014; Banker and Byzalov 2014; Bugeja et al. 2015; Subramaniam and Watson 2016).

According to Balakrishnan et al. (2004), the level of capacity utilization influences managers' response to a change in activity level. If capacity utilization is high, managers are not likely to instantly cut resources in response to a decrease in activity level because the decline may be temporary, which creates stickiness in cost reduction. In contrast, if the firm has excess capacity, managers regard an additional decrease in activity level as confirming a permanent demand reduction. In such a case, the cost response to an activity level decrease is more substantial than an increase, resulting in anti-sticky costs. As sales

decrease, sticky costs generate lower profits than anti-sticky costs, resulting in more profit volatility.

Banker and Chen (2006) improved their earnings prediction model by estimating the excessive costs caused by cost stickiness when sales decrease. They showed that cost behavior explained a considerable portion of the analysts' advantage in earnings prediction. Banker et al. (2017) concluded that analysts considered the asymmetric nature of costs to some extent because analysts' earnings forecasts were more in line with the cost stickiness model of Banker and Chen (2006) than the traditional proportional cost model. However, analysts do not fully reflect the cost behavior when forecasting earnings (Kim and Kinsey 2010), resulting in a systemic estimation bias.

Weiss (2010) finds that analysts suffer less accurate earnings forecasts for firms with stickier cost behavior than firms with anti-sticky costs. Considering that accurate earnings forecast decreases forecasts dispersion (Brown et al. 1987), Weiss (2010)'s finding means that stickier costs increases forecast dispersion. Each analyst's different ability to understand cost behavior might be the reason for their different forecast accuracy (Banker et al. 2016).

Alford and Berger (1999) and Weiss et al. (2008) discovered positive relationships between forecast accuracy and analyst coverage. In a Weiss (2010)'s research, firms with stickier costs and less accurate earnings forecasts have lower analyst coverage, which indicates that analysts are likely to prefer covering firms with less sticky cost behavior to achieve more accurate earnings forecasts.

2.2 Hypothesis Developments

Analysts utilize financial statement data as the primary input of their decision models for earnings forecasts. Other information available to financial analysts includes public information, such as industry trends, stock market conditions, and macroeconomic factors, as well as private information obtained from managers through personal networks.

Easley and O'Hara (2004) regarded private information as signals observable only to informed investors. Other analytical studies have defined private information to capture the informed judgments or opinions of informed investors (e.g., Harris and Raviv 1993; Holthausen and Verrecchia 1990; Indjejikian 1991; Kim and Verrecchia 1991, 1994). Investors with superior information processing ability can process public information into

value-relevant private information (Kim and Verrecchia 1994).

Addressing the relation between financial disclosure and information quality, Byard and Shaw (2003) reported that high-quality annual and quarterly reports increased the precision of both analysts' public (common) and private (idiosyncratic) information. Byard et al. (2011) found that mandatory IFRS adoption decreased forecast errors and dispersion. Based on Barron et al. (1998)'s model, they examined whether the improvement in analysts' information environment under IFRS is attributable to an increase in analysts' information quality and discovered the improvement in both public and private information precision.

As studies have shown that accounting characteristics affect analyst's information environment in terms of the quality of public and private information (Byard and Shaw 2003; Byard et al. 2011), we conjecture that the impact of sticky costs on analyst' information environment reported by Weiss (2010) can also be explained by the change in the public and private information. As Weiss (2010) reported that stickier cost behavior increases earnings variability and as a result reduces forecast accuracy, we may expect that sticky costs lessen the accuracy of public and/or private information. We state our first hypothesis as follows:

Hypothesis 1: Stickier cost behavior is associated with decreasing precision of analysts' public information, private information, or both.

Some studies have documented the relationship between private information and the accuracy of analysts' earnings forecasts. Analysts improve their earnings forecast accuracy by acquiring private information from management (Ke and Yu 2006). Conference calls increase analyst earnings forecast accuracy (Bowen et al. 2002), and analysts attending conference calls have private interactions with management immediately after the calls (Stoles 2014). According to Chen and Matsumoto (2006), analysts who issue favorable recommendations have greater access to the management, thus improving the accuracy of their earnings forecasts. The information from the management is the most important among the various sources they use to improve the accuracy of their forecasts.

As studies have shown the relationship between a firm's private information and analyst forecast accuracy, we suggest that the higher the proportion of private information to the total information utilized by analysts to forecast future earnings, the higher the accuracy of the forecasts. If analysts work harder to acquire more private information, then in firms

with stickier cost behavior, the errors of earnings forecasts would also be minimized. We hypothesize that earnings forecast errors are reduced for firms with cost stickiness when analysts increase their reliance on private information:

Hypothesis 2: As reliance on private information increases, the accuracy of analysts' earnings forecasts would improve for firms with cost stickiness.

Forecasting failures motivate analysts to increase their reliance on private information relative to public information. First, significant earnings surprises impair financial analysts' reputations and threaten their job security (Stickel 1992; Mikhail et al. 1999). Negative earnings surprises (i.e., bad earnings news) mean more forecasting failures than positive earnings surprises because market prices drop disproportionately when earnings fall short of the average forecast (e.g., Bartov et al. 2002; Skinner and Sloan 2002). Such bad earnings news does not merely hurt the wealth of investors who are analysts' clients. It deteriorates analysts' relationships with management because negative earnings surprise damage managers' wealth and reputation (Richardson et al. 2004; Ke and Yu 2006). Therefore, financial analysts have incentives to acquire relatively more private information in an effort to reduce future forecast errors.

Second, firms with both significant and negative earnings surprises are less likely to issue voluntary public disclosures (Waymire 1985; Miller 2002). As it limits the availability of public information, analysts have a stronger motivation to incorporate private information in their forecasts.

Third, prior research has found that both large earnings surprises and negative earnings surprises are less persistent (Freeman and Tse 1992; Basu 1997). This makes the currently issued earnings less helpful in predicting future earnings. Thus, investors' demand for analysts' information is likely higher after relatively large or negative earnings surprises (Stickel 1989). Financial analysts rely relatively less on these less-persistent public disclosures. Prior research has shown that analysts try to identify whether earnings surprises are less persistent (Ali et al. 1992; Mest and Plummer 2000) and attempt to forecast earnings that are more persistent (Gu and Chen 2004).

Extending these prior findings, Barron et al. (2008) show that after significant or negative earnings surprises, analysts rely more heavily on their private information about upcoming earnings. Weiss (2010) reports that firms with stickier cost behavior have less accurate

analysts' earnings forecasts; therefore, these firms may show larger or more frequent earnings surprises than firms with less sticky cost behavior. Analysts understand the asymmetric nature of costs but only partially (Kim and Kinsey 2010; Banker et al. 2017). Because stickier costs reduce earnings predictability, investors and analysts need more information for companies with asymmetric cost structures (Ciftci and Salama 2018). We conjecture that when analysts forecast future earnings, sticky cost behavior prompts analysts to acquire more private information than public information to avoid future forecasting failures. Accordingly, we state our third hypothesis as follows:

Hypothesis 3: Stickier cost behavior increases analysts' reliance on private information in forecasting future earnings.

Ⅲ. Sample seleciton and Research Design

3.1 Sample selection

We tested our hypotheses using a sample of Korean listed firms between 2001 and 2013 meeting the following data requirements. We obtained annual financial data from KisValue Ⅲ and one-year ahead earnings per share forecasts from Fn-guide[2]. Following Clement (1999), we make sure that none of the considered earnings forecasts were issued earlier than one year before the given fiscal year-end. We also excluded forecasts that were released after the actual earnings announcement dates or three months after the given fiscal year-end.

We excluded financial and utility firms because financial and utility firms operate in highly regulated industries with different accounting rules from those in other industries. Further, each firm is required to have a fiscal year ending in December. Also, we excluded firms without financial or stock return data available. We winsorized all the dependent and independent variables at the 1% and 99% levels to control the influence of outliers.

2) KisValue Ⅲ and Fn-guide are Korean databases that provide financial data and analyst coverage. They are similar to COMPUSTAT and I/B/E/S database, respectively.

3.2 Measurement of key variables

3.2.1 Measurement of cost stickiness

The following model (1) is based on the cost stickiness model proposed by Weiss (2010). While Anderson et al. (2003) used the cross-sectional and time-series regression model to estimate cost stickiness, Weiss (2010) introduces a direct measure of the firm-level cost stickiness. Weiss (2010) defined cost stickiness by calculating the difference between the rate of cost decrease for recent quarters with decreasing sales and the corresponding rate of cost increase for recent quarters with increasing sales:

$$Sticky(Weiss)_{i,t} = log\left(\frac{\triangle \cos t}{\triangle sale}\right)_{i,\underline{\tau}} - log\left(\frac{\triangle \cos t}{\triangle sale}\right)_{i,\bar{\tau}} \quad \underline{\tau},\ \bar{\tau} \in t,\ \cdots,\ t-3,$$

$$Sticky_{i,t} = Sticky(Weiss)_{i,t} \times (-1) \tag{1}$$

where τ: most recent of the last four quarters with a decrease in sales
$\bar{\tau}$: most recent of the last four quarters with an increase in sales
$\triangle Sale_{i,t}$: $Sale_{i,t} - Sale_{i,t-1}$
$\triangle Cost_{i,t}$: $Cost_{i,t} - Cost_{i,t-1}$

We employed three different costs, including total costs (sales minus operating earnings), Cost of Goods Sold (hereafter, COGS), and SGA costs. Following Weiss (2010), cost stickiness is defined as the difference between the decreasing rate of costs and the increasing rate of costs in the two most recent quarters (from quarter t−3 to quarter t). If costs become sticky, the increasing rate of costs when sales increase is larger than the decreasing rate of costs when sales decrease by an equivalent amount. As the value proposed by Weiss (2010) initially produces a negative value for *Sticky*, we multiply by −1 to interpret that cost stickiness gets bigger as *Sticky* becomes larger. Finally, we transformed *Sticky* into [0, 1] decile rank values to reduce the influence of outliers.[3)]

3.2.2 Measurement of analysts' information precision

We utilize the measures of Barron et al. (1998) to empirically capture the average

3) We first transform STICKY into [0,1] decile ranks (i.e. each raw variable is ranked into deciles of 0−9. Then we divide the decile ranks by 9) (Francis et al. 2008; Byard et al. 2011).

precision of analysts' public (*PUBLIC*) and private (*PRIVATE*) information and analysts' consensus (*CONSENSUS*) used by analysts when forecasting a firm's future earnings:

$$Public(common) = \frac{SE - D/N}{[(1-1/N)D + SE]^2} \quad (2)$$

$$Private(Idiosyncratic) = \frac{D}{[(1-1/N)D + SE]^2} \quad (3)$$

$$Consensus = \frac{Public}{(Public + Private)} \quad (4)$$

where *SE*: the expected squared error in the mean forecast,
D : the expected forecast dispersion,
N : the number of forecasts for firm i in year t

PUBLIC and *PRIVATE* are measured using the variance of analysts' forecasts (*D*), the squared error in the mean forecast (*SE*), and the number of analysts forecasting (*N*) (see Barron et al. [1998], Corollary 1, p.428). *CONSENSUS* estimates the ratio of public information to total information in the average analysts' forecast. Utilizing *CONSENSUS* we tested whether the degree to which analysts' forecasts of future earnings incorporate private information relative to public information increases as the firm-level cost stickiness increases. We use the within-year fractional rank to reduce the influence of outliers and skewness. Specifically, we transform *PUBLIC, PRIVATE,* and *CONSENSUS* into [0, 1] decile ranks (Botosan et al. 2004; Byard et al. 2011)[4].

3.3 Research Design

To test Hypothesis 1 and examine the impact of cost stickiness on the precision of public information that is common to all analysts, and the precision of private information that is idiosyncratic to an individual analyst, and analysts' consensus, we estimate equation (5) using *PUBLIC, PRIVATE,* and *CONSENSUS* as the dependent variables:

$$Info.Envir_{it} = \beta_0 + \beta_1 Sticky_{it} + \beta_2 N_{it} + \beta_3 Size_{it} + ind + year + \epsilon \quad (5)$$

Where, $Info.Envir_{it}$ refers to *PUBLIC, PRIVATE,* and *CONSENSUS*, while *STICKY* denotes

4) Each raw variable is ranked into deciles of 0~9. Then we divide the decile ranks by 9 (Botosan et al. 2004; Francis et al. 2008; Byard et al. 2011).

measures of cost stickiness proposed by Weiss (2010). Specifically, we use *T_STICKY, COGS_STICKY*, and *SGA_STICKY* as the independent variables in equation (5), where, *T_STICKY* is the measure of cost stickiness based on total cost, *COGS_STICKY* is the measure of cost stickiness based on the cost of goods sold, and *SGA_STICKY* is the measure of cost stickiness based on SGA costs. Also, we include firm-specific controls (*N, Size*) that are known to influence analysts' information environment (Atiase 1985; Watts and Zimmermanm 1986; Barron et al. 2002). *N* is the natural log of the number of analysts following a firm, and *Size* is measured by the natural log of the total market value of equity at the end of the year. We also controlled industry and year fixed effects.

Weiss (2010) reports that firms with sticky costs have less accurate analysts' earnings forecasts than firms with less sticky cost behavior. Through Hypothesis 1, we tested whether the decrease in analysts' information environment of firms with cost stickiness is attributable to a decrease in the precision of analysts' public information, private information, or both. Our expectation is that cost stickiness decreases analysts' public and private information; however, which to decrease more is the question of empirical test.

Equation (6) is formulated to test Hypothesis 2 and examine whether analysts' reliance on private information can explain the changes in forecast accuracy. Specifically, we investigate whether forecast accuracy improves more for firms with cost stickiness when analysts increase their reliance on private information:

$$\begin{aligned} AFE_{it} = \beta_0 &+ \beta_1 Sticky_{it} + \beta_2 PRI_{it} + \beta_3 PRI_{it} \times Sticky_{it} + \beta_4 Size_{it} + \beta_5 Lev_{it} \\ &+ \beta_6 DISP_{it} + \beta_7 N_{it} + \beta_8 VOL_{it} + \beta_9 ROE_{it} + \beta_{10} Loss_{it} \\ &+ ind + year + \epsilon_{it} \end{aligned} \quad (6)$$

Where, *AFE* is the absolute value of analyst forecast error for firm i and year t. Higher values of *AFE* indicate less accurate forecasts. We obtain analysts' absolute forecast error(*AFE*) for each firm-year as follows: [$|ActualEarnings_{it} - MeanForecast_{it}| / StockPrice_{it}$]. *Actual Earnings* is the actual annual EPS for firm i in year t. *Mean Forecast* is the mean of EPS forecasts made by analysts during the 12 month period prior to the fiscal year-end for firm i and year t. *Stock Price* is the stock price of firm i at the beginning of year t. Also, we measure analysts' reliance on private information (*PRI*) as 1-*CONSENSUS*. Thus, *PRI* is the ratio of private information to total information in the average analysts forecast.

Weiss (2010) reports that stickier cost behavior results in higher forecast error. Thus, β_1

is predicted to be positive. Prior studies such as Bowen et al. (2002), Chen and Matsumoto (2006), and Ke and Yu (2006) have demonstrated that analysts' reliance on private information increases the accuracy of their forecasts. Therefore, the coefficient of *PRI* (β_2) is expected to be negative. If greater dependence on private information decreases the errors of analysts' forecasts of firms with cost stickiness, then the coefficient of interest to test Hypothesis 2, PRI_{it}*$STICKY_{it}$ (β_3) could be significantly negative.

Prior studies have suggested various factors that might affect forecast errors (Lang and Lundholm 1996; Clement 1999; Duru and Reeb 2002). We selected control variables including the natural logarithm of the market value of equity (*Size*), total liabilities to total equity (*Lev*), forecast dispersion (*DISP*) calculated as the standard deviation of the ratio of forecasts to stock price, the natural log of analyst coverage (*N*), stock price volatility using a standard deviation of daily stock returns (*VOL*), current year's return on equity (*ROE*), and reporting negative income (*Loss*) using 1 if net income <0, 0 otherwise.

Analyst' forecasting error decreases if the quantity of information of individual firms increases. The quantity of information demanded by analysts is positively related to firm size (Atiase 1985; Collins et al. 1987; Bhushan 1989). Accordingly, *Size* is controlled and expected to be negatively related to *AFE*. Eddy and Seifert (1992) showed that the accuracy of analysts' forecasts of firms decreased with higher leverage. Thus, *Lev* is expected to be positively associated with *AFE*. Lang and Lundholm (1996) documented that a higher number of analysts analyzing a particular firm produced a larger quantity of information that they could use. Thus, *N* (natural log of analysts following a firm) is expected to be negatively related to *AFE*. The uncertainty of a firm's information environment can affect analyst forecast accuracy; thus, this study controls for *DISP*, which measures the degree of uncertainty related to the earnings. The profitability of a firm tends to continue for several years (Penman 1991), and the profitability of a firm is positively related to analysts' forecast accuracy because more analysts are following as a firm's profitability increases for several years (McNichols and O'Brien 1997). Thus, we expect *ROE* to be negatively related to *AFE*. Loss is related to more significant absolute forecast errors (Brown 2001), so we control for *Loss*.

We used equation (7) to test Hypothesis 3, which claims that stickier costs increase the future reliance on private information relative to public information.

$$\triangle CONSENSUS_{it+1} = \beta_0 + \beta_1 Sticky_{it} + \beta_2 N_{it} + \beta_3 Size_{it} + ind + year + \epsilon_{it} \quad (7)$$

We calculated the change in *CONSENSUS* (*△CONSENSUS*) as follows: *△CONSENSUS*= $CONSENSUS_{t+1} - CONSENSUS_t$. We include the number of analysts (*N*) and firm size (*Size*) as control variables following Barron, Byard, and Yu (2008). Barron, Byard, and Kim (2002) discovered more significant decreases in *CONSENSUS* after earnings announcements where N is greater; thus, *N* is expected to be negatively associated with *△CONSENSUS*. Byard (1998) reported that *CONSENSUS* decreases faster for larger firms. We thus predict that *Size* is negatively associated with *△CONSENSUS* (Barron et al. 2008). If analysts base their individual forecasts relatively more on private information at time t+1 when they encounter firms with cost stickiness at time t, then *Sticky* (β_1) would have a significantly negative value.

Ⅳ. Empirical Results

4.1 Descriptive statistics

Table 4-1 presents the descriptive statistics for the relevant variables. The means (medians) of *AFE*, *DISP*, and *N* are 0.049 (0.016), 0.005 (0.000), and 0.906 (0.693), respectively. The mean (median) values of *T_STICKY* and *COGS_STICKY* are 0.185 (0.113) and 0.107(0.061). Also, the mean (median) value of *SGA-STICKY* is 0.107 (0.097). All means (medians) are positive as we multiplied by (-1) to generate our *Sticky* measures, in which the stickier firms have the higher value of the variables. On average, total costs, COGS and SGA costs exhibit sticky cost behaviors, while Weiss (2010) showed that COGS were anti-sticky. The mean (median) value of *CONSENSUS*, which is the ratio of public-to-total information in the average analyst forecasts, is 0.570 (0.690). It indicates that the proportion of public information in the average analyst forecast is about 57%. As the control variables show, the means of *Size, Lev VOL, ROA*, and *Loss* are 24.916, 1.151, 59.791, 0.030, and 0.210, respectively.

<Table 4－1> Descriptive Statistics

Variable	Mean	Std. Dev.	Q1	Median	Q3
AFE	0.049	0.118	0.006	0.016	0.042
CONSENSUS	0.570	0.319	0.294	0.690	0.898
T_STICKY	0.185	1.079	－0.253	0.113	0.588
COGS_STICKY	0.107	1.040	－0.310	0.061	0.501
SGA_STICKY	0.107	1.918	－1.022	0.097	1.234
SIZE	24.916	1.524	23.871	24.647	25.634
LEV	1.151	1.622	0.365	0.761	1.380
DISP	0.005	0.012	0.000	0.000	0.006
N	0.906	1.013	0.000	0.693	1.609
VOL	59.791	25.940	42.133	55.650	72.336
ROA	0.030	0.125	0.006	0.041	0.087
LOSS	0.210	0.407	0.000	0.000	0.000

1) This table presents the descriptive statistics for the firms based on their listing status. The sample consists of 2,581 firm－year observations between 2001 and 2013 for firms with all of the necessary data available.

2) Definition of variables: where *AFE*: analysts' absolute forecast error＝¦actual earnings－consensus forecast¦ / stock price; *DISP*: standard deviation of forecasts / stock price; *N*: log (number of analysts following a firm); *CONSENSUS*: analysts' reliance on public information; *STICKY(Weiss)*: measures of cost stickiness as in Weiss (2010); a. *T_STICKY*: measure of cost stickiness based on total cost (sales －operating profit); b. *COGS_STICKY*: measure of cost stickiness based on cost of goods sold; c. *SGA_STICKY*: measure of cost stickiness based on selling, general, and administrative costs; *SIZE*: log (total market value of equity at the end of the year); *LEV*: total liabilities / equity; *VOL*: stock price volatility; *ROA*: net income / total assets; *LOSS*: 1 if net income ＜0, 0 otherwise.

In Table 4－2, we provide the Pearson correlations among our dependent variables and our primary explanatory variables. We show test results for decile rank specifications. As expected, the correlation coefficient between *STICKY* (*T_STICKY*, *COGS_STICKY*, and *SGA－STICKY*) and *AFE* are positive, suggesting a positive relationship between cost stickiness and the absolute analysts earnings forecast errors. However, *SGA－STICKY* and *AFE* are only significantly correlated. As expected, our primary explanatory variable *T_STICKY* is significantly positively correlated with *COGS－STICKY* and with *SGA－STICKY*. Also, the correlation between *COGS－STICKY* and *SGA－STICKY* is significantly positive, whereas *N* and *STICKY* (*T_STICKY*, *COGS_STICKY* and *SGA－STICKY*) are insignificantly negatively correlated. Overall, these results are consistent with those of the Weiss (2010) study.

CONSENSUS is significantly positively correlated with *T_STICKY*, *COGS_STICKY*, and *SGA_STICKY*, respectively. This suggests that the ratio of public-to-total information in the average forecast increases more for firms with sticker cost behavior.

<Table 4-2> Correlations among Dependent and Independent Variables

Variable	1	2	3	4	5	6	7	8	9
1. *AFE*	1								
2. *DISP*	0.141***	1							
3. *N*	-0.135***	0.329***	1						
4. *PUBLIC*	0.047***	-0.063***	-0.033**	1					
5. *PRIVATE*	-0.314***	-0.190***	-0.269***	0.053***	1				
6. *CONSENSUS*	0.300***	0.025	0.052***	0.763***	-0.408***	1			
7. *T_STICKY*	0.025	-0.010	-0.015	0.003	-0.024	0.017*	1		
8. *COGS_STICKY*	0.020	-0.019	-0.015	0.029	-0.034*	0.023*	0.664***	1	
9. *SGA_STICKY*	0.080***	-0.002	-0.024	0.017	-0.015	0.036*	0.317***	0.113***	1

1) This table presents the Pearson correlations among main variables.
2) ***, ** and * indicate statistical significance at the 1%, 5% and 10% level (two-tailed), respectively.
3) See Table 4-1 for variable definitions.

4.2 Test result for Hypothesis 1

Table 4-3 shows the test results based on equation (5), which regresses analysts' information quality on cost stockiness and the control variables. As shown in Panel A of Table 4-3, the coefficients of *T_STICKY* and *SGA_STICKY* in models 1 and 3 are negative and statistically insignificant for the PUBLIC information. Only the coefficient of *COGS_STICKY* in model 2 is negative and significant at the 10 percent level, indicating a certain level of decline in analysts' public information for firms with stickier cost behavior. Panel B of Table 4-3 shows that the coefficients of *T_STICKY*, *COGS_STICKY*, and *SGA_STICKY* are all negative and statistically significant at the 5 to 10 percent levels. The results clearly show that as firms have stickier costs, they suffer from lower analyst private information.

<Table 4－3> Cost Stickiness and Analysts' Information Environment

[Panel A] Dependent Variables: PUBLIC Information			
explanatory variable (Sticky measures):	**Model 1** *T_Sticky*	**Model 2** *COGS_Sticky*	**Model 3** *SGA_Sticky*
Intercept	0.820*** (3.538)	0.509** (2.174)	0.770** (2.172)
STICKY(Weiss)	－0.007 (－0.378)	－0.033* (－1.649)	－0.037 (－1.433)
N	0.010 (1.069)	0.011 (1.128)	0.012 (1.131)
SIZE	－0.014** (－2.391)	－0.014** (－2.413)	－0.013* (－1.942)
Industry dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
No. of observations	2,581	2,532	1,958
Adjusted R－square	0.025	0.027	0.033
[Panel B] Dependent Variables: PRIVATE Information			
explanatory variable (Sticky measures):	**Model 1** *T_Sticky*	**Model 2** *COGS_Sticky*	**Model 3** *SGA_Sticky*
Intercept	2.378*** (11.846)	2.405*** (11.834)	2.870*** (9.280)
STICKY(Weiss)	－0.040** (－2.364)	－0.065** (－2.016)	－0.059* (－1.932)
N	0.015* (1.909)	0.015* (1.782)	0.025*** (2.657)
SIZE	－0.080*** (－15.728)	－0.079*** (－15.434)	－0.089*** (－15.036)
Industry dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
No. of observations	2,581	2,532	1,958
Adjusted R－square	0.256	0.258	0.279

1) model: $Info.Envir_{it} = \beta_0 + \beta_1 STICKY_{it} + \beta_2 N_{it} + \beta_3 SIZE_{it} + IND + YEAR + \varepsilon_{it}$
Info.Envirit refers to *PUBLIC*, *PRIVATE*, based on Barron et al. (1998). *STICKY(Weiss)* denotes cost stickiness by Weiss (2010). *T_STICKY* is the cost stickiness of total cost, *COGS_STICKY* is the cost stickiness of cost of goods sold, and *SGA_STICKY* is the cost stickiness based on SGA costs. *N* is the natural log of the number of analysts following a firm, and *SIZE* is the natural log of the total market value of equity at the end of the year. The three panels collectively show that firm cost stickiness decrease the precision of private information more than that of public information.
2) t－stat obtained from a two－way clustering by firm and year.
3) ***, ** and * indicate statistical significance at the 1%, 5% and 10% level(two－tailed), respectively.

The findings in Table 4−3 suggest that, first, the decline in analysts' information environment of firms with sticky cost behavior is attributable to a decrease in analysts' public information and private information. Second, cost stickiness is more likely to decrease the precision of private information than that of public information.

4.3 Test result for Hypothesis 2

<Table 4−4> Cost Stickiness and Absolute Analysts' Forecast Errors through Their Reliance on Private Information

Dependent Variables: *AFE*			
explanatory variable (Sticky measures):	**Model 1** *T_Sticky*	**Model 2** *COGS_Sticky*	**Model 3** *SGA_Sticky*
Intercept	0.632 (0.896)	0.217 (0.295)	0.222 (0.245)
STICKY(Weiss)	0.015** (2.335)	0.117* (1.749)	0.237** (2.166)
PRI	−0.254** (−2.220)	−0.253*** (−2.747)	−0.346*** (−3.028)
*PRI*STICKY(Weiss)*	−0.025** (−2.335)	−0.077*** (−2.860)	−0.108*** (−2.963)
SIZE	−0.010 (−0.543)	−0.011 (−0.588)	0.013 (0.766)
LEV	−0.009 (−0.763)	−0.010 (−0.814)	−0.071*** (−6.170)
DISP	4.555*** (3.929)	4.715*** (3.934)	0.233 (0.189)
N	−0.021 (−0.734)	−0.018 (−0.609)	−0.039 (−1.388)
VOL	−0.000 (−0.073)	0.000 (0.069)	0.000 (0.349)
ROA	−2.298*** (−10.811)	−2.398*** (−10.820)	−1.929*** (−10.248)
LOSS	0.085 (1.238)	0.087 (1.210)	0.117* (1.755)
Industry dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
No. of observations	2,503	2,384	1,903
Adjusted R−square	0.098	0.100	0.096

1) model: $AFE_{it} = \beta_0 + \beta_1 STICKY_{it} + \beta_2 PRI_{it} + \beta_3 PRI_{it} * STICKY_{it} + \beta_4 SIZE_{it} + \beta_5 LEV_{it} + \beta_6 DISP_{it} + \beta_7 N_{it} + \beta_8 VOL_{it} + \beta_9 ROE_{it} + \beta_{10} LOSS_{it} + IND + YEAR + \varepsilon_{it}$

AFE is the absolute value of analyst forecast error from the equation: ¦Actual Earnings−Mean Forecast ¦ / Stock Price. *STICKY(Weiss)* denotes cost stickiness by Weiss (2010). *T_STICKY* is the cost stickiness of total cost, *COGS_STICKY* is the cost stickiness of cost of goods sold, and *SGA_STICKY* is the cost stickiness based on SGA costs. *PRI* is the analyst reliance on private information calculated by 1−*CONSENSUS*. Other variables are as defined in Table 4−1. Table 4−4 shows that the interaction effect of firm cost stickiness and the reliance on private information is to decrease forecast error.

2) t-stat obtained from a two-way clustering by firm and year.

3) ***, ** and * indicate statistical significance at the 1%, 5% and 10% level(two-tailed), respectively.

Hypothesis 2 argues that analysts can reduce their earnings forecast errors for firms with stickier costs by increasing their reliance on private information. In Table 4−4, the coefficients of *T_STICKY*, *COGS_STICKY*, and *SGA_STICKY* are all positive and statistically significant. The results are similar to those of the Weiss (2010) study, indicating that stickier cost behavior is associated with lower accuracy of analysts' earnings forecasts. The coefficients of *PRI* (β_2) are significantly negative in three cost measures, which shows that analysts' reliance on private information increases the accuracy of their forecasts. The coefficient of interest to test Hypothesis 2, *PRI***STICKY* (β_3), is significantly negative for all three models. This results support Hypothesis 2, indicating that greater dependence on private information decreases the errors of analysts' forecasts of firms with cost stickiness.

4.4 Test result for Hypothesis 3

Financial analysts have incentives to acquire more private information in an effort to reduce future forecast errors. Weiss (2010) reports that analysts for firms with stickier cost behavior suffer from less accurate analyst earnings forecasts. As Ke and Yu (2006) and Bowen et al. (2002) show that private information provides more accurate forecasts, we expect that analysts who encountered sticky cost behavior increase their effort to acquire more private information to avoid forecasting failures when forecasting future earnings.

Table 4−5 presents the results of equation (7) which tests Hypothesis 3. The results are consistent with our predictions that *T_STICKY*, *COGS_STICKY*, and *SGA_STICKY* are all significantly negatively related to $\triangle CONSENSUS$. These results support our expectation that sticky cost behavior is associated with greater decreases in consensus in the next period and, thus, an increase in analyst reliance on private information.

<Table 4−5> Impact of the Cost Stickiness at Time t on the Analysts' Private Information at Time t+1

Dependent Variables: *△CONSENSUS*			
explanatory variable (Sticky measures):	**Model 1** *T_Sticky*	**Model 2** *COGS_Sticky*	**Model 3** *SGA_Sticky*
Intercept	−0.116 (−0.378)	0.363 (1.150)	0.373 (1.022)
STICKY(Weiss)	−0.089*** (−2.688)	−0.067** (−2.005)	−0.071** (−2.429)
N	0.008 (0.582)	0.009 (0.700)	0.001 (0.064)
SIZE	−0.003 (−0.292)	−0.004 (−0.424)	0.002 (0.156)
Industry dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
No. of observations	1,796	1,752	1,394
Adjusted R-square	0.014	0.008	0.005

1) model: $\triangle CONSENSUS_{it+1} = \beta_0 + \beta_1 STICKY_{it} + \beta_2 Ni_{it} + \beta_3 SIZEi_{it} + IND + YEAR + \varepsilon_{it}$
△CONSENSUS is the change in *CONSENSUS*, or $CONSENSUS_{t+1} - CONSENSUS_t$. *STICKY(Weiss)* denotes cost stickiness by Weiss (2010). *T_STICKY* is the cost stickiness of total cost, *COGS_STICKY* is the cost stickiness of cost of goods sold, and *SGA_STICKY* is the cost stickiness based on SGA costs. Other variables are as defined in Table 4−1. Table 4−5 shows that as firm stickiness increases, analysts increase their reliance on private information.
2) t-stat obtained from a two-way clustering by firm and year.
3) ***, ** and * indicate statistical significance at the 1%, 5% and 10% level(two-tailed), respectively.

4.5 Robustness Tests

In this subsection, we check the robustness of our results by employing an alternative measure. Specifically, we replace the measure of cost stickiness suggested by Weiss (2010) with that of Homburg and Nasev (2008) in Equations (5), (6), and (7).

Anderson et al. (2007) define the *SGAratio* as the difference between the current and lagged ratio of *SGA* costs to sales:

$$SGAratio_{i,t} = [SGA_{i,t}/Sales_{i,t} - SGA_{i,t-1}/Sales_{i,t-1}] \quad (8)$$

Using the *SGAratio*, Homburg and Nasev (2008) measure cost stickiness as the SGA ratio

conditional on decreasing sales and conditional on SGA costs falling proportionately in comparison to sales; thus, implying a positive SGA ratio:

$$Sticky(HN)_{i,t} = SGAratio_{i,t} \times Dsales_{i,t} \times DSGA_{i,t}$$
$$= [SGA_{i,t}/Sales_{i,t} - SGA_{i,t-1}/Sales_{i,t-1}] \times Dsales_{i,t} \times DSGA_{i,t}$$

where $Dsales_{i,t}$: 1 if $(Sales_{i,t}/Sales_{i,t-1}) < 1$, 0 otherwise,
$DSGA_{i,t}$: 1 if $[SGA_{i,t}/Sales_{i,t} - SGA_{i,t-1}/Sales_{i,t-1}] > 0$, 0 otherwise.

All variables are as defined in section 3.

Table 4−6 shows test results for H1 based on the cost stickiness measure designed by Homburg and Nasev (2008). Panel A of Table 4−6 shows that the coefficient of *T_STICKY* is negative and statistically significant at the 1 percent significance level, while the coefficients of *COGS_STICKY* and *SGA_STICKY* are negative but statistically insignificant. As shown in Panel B of Table 4−6, the coefficients of *T_STICKY*, *COGS_STICKY*, and *SGA_STICKY* are all negative and statistically significant at 1 or 5 percent significance levels for the PRIVATE. Panel C of Table 4−6 shows that the coefficients of cost stickiness are significantly positive for *CONSENSUS*, except *SGA_STICKY*. Overall, test results based on the Homburg and Nasev (2008)'s measurement are similar to those reported in Table 4−3.

<Table 4−6> Cost Stickiness and Analysts' Information Environment, Using the Cost Stickiness Measure from Homburg and Nasev (2008)

[Panel A] Dependent Variables: PUBLIC Information			
explanatory variable (Sticky measures):	**Model 1** *T_Sticky*	**Model 2** *COGS_Sticky*	**Model 3** *SGA_Sticky*
Intercept	1.119*** (4.302)	1.096*** (4.201)	0.951*** (3.604)
STICKY(HN)	−0.082*** (−2.820)	−0.034 (−1.129)	−0.022 (−0.843)
N	0.017 (1.434)	0.016 (1.368)	0.017 (1.395)
SIZE	−0.028*** (−3.561)	−0.027*** (−3.448)	−0.028*** (−3.465)
Industry dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
No. of observations	1,087	1,087	1,087
Adjusted R-square	0.069	0.063	0.063

<Table 4−6> Cost Stickiness and Analysts' Information Environment, Using the Cost Stickiness Measure from Homburg and Nasev (2008) (continued)

[Panel B] Dependent Variables: PRIVATE Information			
explanatory variable (Sticky measures):	**Model 1** *T_Sticky*	**Model 2** *COGS_Sticky*	**Model 3** *SGA_Sticky*
Intercept	2.134*** (8.048)	2.102*** (7.888)	2.115*** (7.858)
STICKY(HN)	−0.111*** (−3.723)	−0.078*** (−2.608)	−0.069** (−2.568)
N	0.019 (1.577)	0.018 (1.486)	0.019 (1.564)
SIZE	−0.071*** (−8.853)	−0.070*** (−8.673)	−0.071*** (−8.764)
Industry dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
No. of observations	1,087	1,087	1,087
Adjusted R−square	0.253	0.245	0.246
[Panel C] Dependent Variables: CONSENSUS			
explanatory variable (Sticky measures):	**Model 1** *T_Sticky*	**Model 2** *COGS_Sticky*	**Model 3** *SGA_Sticky*
Intercept	0.408 (1.482)	0.404 (1.471)	0.115 (0.412)
STICKY(HN)	0.052* (1.680)	0.054** (2.007)	0.008 (0.275)
N	−0.007 (−0.559)	−0.007 (−0.586)	−0.007 (−0.588)
SIZE	0.008 (0.924)	0.008 (0.949)	0.008 (0.986)
Industry dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
No. of observations	1,087	1,087	1,087
Adjusted R−square	0.028	0.028	0.026

1) model: $Info.Envir_{it} = \beta_0 + \beta_1 STICKY_{it} + \beta_2 Ni_{it} + \beta_3 SIZEi_{it} + IND + YEAR + \varepsilon_{it}$
Info.Envirit refers to *PUBLIC, PRIVATE*, and *CONSENSUS* based on Barron et al. (1998). *STICKY (HN)* denotes cost stickiness by Homburg and Nasev (2008). *T_STICKY* is the cost stickiness of total cost, *COGS_STICKY* is the cost stickiness of cost of goods sold, and *SGA_STICKY* is the cost stickiness based on SG&A costs. Other variables are as defined in Table 4−1. Table 4−6 provides consistent test results with table 4−3 by showing that firm cost stickiness decrease the precision of private information more than that of public information.
2) t−stat obtained from a two−way clustering by firm and year.
3) ***, ** and * indicate statistical significance at the 1%, 5% and 10% level(two−tailed), respectively.

Table 4−7 shows test results for H2 using the cost stickiness measure provided by Homburg and Nasev (2008).

<Table 4−7> Cost Stickiness and Absolute Analysts' Forecast Errors through Their Reliance on Private Information, Using the Measure of Cost Stickiness from Homburg and Nasev (2008)

Dependent Variables: *AFE*			
explanatory variable (Sticky measures):	**Model 1** *T_Sticky*	**Model 2** *COGS_Sticky*	**Model 3** *SGA_Sticky*
Intercept	−0.504 (−0.422)	0.011 (0.010)	−0.017 (−0.014)
STICKY(HN)	2.957*** (9.894)	3.386*** (11.102)	2.045*** (8.170)
PRI	−0.103 (−0.773)	−0.084 (−0.638)	−0.081 (−0.595)
*PRI*STICKY(HN)*	−4.559*** (−9.505)	−5.223*** (−10.576)	−3.331*** (−7.823)
SIZE	0.026 (0.738)	0.037 (1.070)	0.035 (0.982)
LEV	0.123*** (4.977)	0.122*** (4.987)	0.136*** (5.442)
DISP	2.533* (1.721)	2.506* (1.721)	2.442 (1.633)
N	−0.086 (−1.623)	−0.108** (−2.077)	−0.093* (−1.729)
VOL	−0.002 (−0.970)	−0.001 (−0.731)	−0.001 (−0.606)
ROA	−2.205*** (−8.205)	−2.195*** (−8.261)	−2.204*** (−8.089)
LOSS	0.093 (0.681)	0.167 (1.248)	0.194 (1.421)
Industry dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
No. of observations	1,070	1,070	1,070
Adjusted R−square	0.229	0.245	0.207

1) model: $AFE_{it} = \beta_0 + \beta_1 STICKY_{it} + \beta_2 PRI_{it} + \beta_3 PRI_{it} * STICKY_{it} + \beta_4 SIZE_{it} + \beta_5 LEV_{it} + \beta_6 DISP_{it} + \beta_7 N_{it} + \beta_8 VOL_{it} + \beta_9 ROE_{it} + \beta_{10} LOSS_{it} + IND + YEAR + \varepsilon_{it}$

AFE is the absolute value of analyst forecast error from the equation: *|Actual Earnings−Mean Forecast| / Stock Price*. *STICKY(HN)* denotes cost stickiness by Homburg and Nasev (2008). *T_ STICKY* is the cost stickiness of total cost, *COGS_STICKY* is the cost stickiness of cost of goods sold, and *SGA_STICKY* is the cost stickiness based on SG&A costs. *PRI* is the analyst reliance on private information calculated by *1−CONSENSUS*. Other variables are as defined in Table 4−1. Table 4−7 provides consistent results with Table 4−4 in that it shows the interaction effects of firm cost stickiness and the reliance on private information which decreases forecast errors.

2) t−stat obtained from a two−way clustering by firm and year.

3) ***, ** and * indicate statistical significance at the 1%, 5% and 10% level(two−tailed), respectively

The coefficients of *T_STICKY*, *COGS_STICKY*, and *SGA_STICKY* are all positively related to *AFE* at the 1 percent significance level. The coefficients of *PRI* are negative in three cost measures, but none of them are statistically significant. And all three coefficients of *PRI***STICKY* are negative at the 1 percent significance level, supporting Hypothesis 2. Overall, the test results in Table 4−7 are consistent with those in Table 4−4.

Utilizing the measure designed by Homburg and Nasev (2008), Table 4−8 replicates tests performed in table 4−5 for Hypothesis 3, which suggests that sticky cost behavior motivates analysts to acquire more private information in the next period. Test results show that the coefficients of *T_STICKY*, *COGS_STICKY*, and *SGA_STICKY* are all negatively associated with $\triangle CONSENSUS$ in all three test models. These results are consistent with our main findings in Table 4−5, supporting the idea that sticky cost behavior increases analysts' reliance on private information to avoid future forecasting failures.

<Table 4−8> Impact of Cost Stickiness in the Current Period on Analysts' Private Information in the Next Period from Homburg and Nasev (2008)

Dependent Variables: $\triangle CONSENSUS$			
explanatory variable (Sticky measures):	**Model 1** *T_Sticky*	**Model 2** *COGS_Sticky*	**Model 3** *SGA_Sticky*
Intercept	−0.282 (−0.729)	−0.264 (−0.683)	0.201 (0.516)
STICKY(HN)	−0.084* (−1.865)	−0.052** (−2.077)	−0.056* (−1.729)
N	0.009 (0.480)	0.010 (0.522)	0.009 (0.483)
SIZE	0.000 (0.009)	−0.001 (−0.046)	0.000 (0.003)
Industry dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
No. of observations	945	945	945
Adjusted R-square	0.016	0.013	0.013

1) model: $\triangle CONSENSUS_{it+1} = \beta_0 + \beta_1 STICKY_{it} + \beta_2 N_{it} + \beta_3 SIZE_{it} + IND + YEAR + \varepsilon_{it}$.
$\triangle CONSENSUS$ is the change in *CONSENSUS*, or $CONSENSUS_{t+1} - CONSENSUS_t$. *STICKY* denotes cost stickiness by Homburg and Nasev (2008). *T_STICKY* is the cost stickiness of total cost, *COGS_STICKY* is the cost stickiness of cost of goods sold, and *SGA_STICKY* is the cost stickiness based on SG&A costs. Other variables are as defined in Table 4−1. Table 4−8 provides consistent results with Table 4−5 because it shows that as firm stickiness increases, analysts increase their reliance on private information.

2) t-stat obtained from a two-way clustering by firm and year.

3) ***, ** and * indicate statistical significance at the 1%, 5% and 10% level(two-tailed), respectively.

Ⅴ. Conclusion

This study investigated the effects of the sticky cost behavior by Korean firms on financial analysts' information environment, utilizing the firm-level cost stickiness measure developed by Weiss (2010). Specifically, we examined (1) whether the decline in analysts' information environment of firms with sticky cost behavior can be attributed to a decrease in the precision of analysts' public information, private information, or both, and (2) whether earnings forecast errors are reduced for firms with cost stickiness when analysts increase their reliance on private information. We also investigated (3) whether stickier cost behavior increases analysts' reliance on private information relative to public information to avoid future forecasting failures in the next period.

Our empirical results revealed the following. First, we found that sticky cost behavior decreases the accuracy of private information more, which means that analysts' earnings forecasts are less accurate for firms with stickier cost behavior due to private information. Second, we found that earnings forecast errors are reduced for firms with cost stickiness when analysts increase their reliance on private information. Finally, we found that stickier cost behavior decreases consensus more in the next period, which means that the proportion of private information in forecasts increases more for firms with stickier cost behavior. As a lack of consensus reflects information asymmetry between relatively informed versus uninformed investors (Botosan et al. 2004; Barron et al. 2005; Barron et al. 2009), our findings imply that information asymmetry is likely more severe for firms with relatively stickier cost behavior. These results are robust to the measure of cost stickiness designed by Homburg and Nasev (2008).

Our findings imply that the level and weight of private information decreased due to the cost stickiness in the current period (related to Hypothesis 1). However, maintaining a high proportion of private information is still an important tool to counter the effect of cost stickiness (related to Hypothesis 2). The last finding of this study is that financial analysts seek ways to secure private information for a certain period of time, and the result appears through an increase in the proportion of private information in the following year (related to Hypothesis 3).

Our study contributes to the understanding of cost stickiness in that we showed the sticky cost's impact on the information environment and information intermediation activities of individual analysts. We also confirmed that analysts private information plays an important

role in improving the accuracy of analysts' earnings forecast for firms with cost stickiness.

Finally, Byard and Shaw(2003) and Byard et al.(2011) suggest that public information complements private information by showing that increasing the level of disclosure enhances the quality of both public (or common) and private (or idiosyncratic) information sets of financial analysts. Our study obtained test results consistent with these studies by confirming that the quality of public and private information decreases *together* as the costs are sticky downward. We believe that our research contributes to the literature in that the relationship between private and public information is still theoretically unclear and empirically relatively untested. However, because our study overviewed only the basic relationships, further studies may be needed to investigate more detailed features in this less explored subject.

REFERENCES

Alford, Andrew W., and Philip G. Berger. 1999. A Simultaneous Equations Analysis of Forecast Accuracy, Analyst Following, and Trading Volume. *Journal of Accounting, Auditing & Finance* 14 (3): 219－240. https://doi.org/10.1177/0148558x9901400303

Ali, Ashiq, April Klein, and James Rosenfeld. 1992. Analysts' Use of Information about Permanent and Transitory Earnings Components in Forecasting Annual EPS. *The Accounting Review* 67 (1): 183－198.

Anderson, Mark C., Rajiv D. Banker, and Surya N. Janakiraman. 2003. Are Selling, General, and Administrative Costs "Sticky"? *Journal of Accounting Research* 41 (1): 47－63. https://doi.org/10.1111/1475-679X.00095

Anderson, Shannon W, and William N Lanen. 2007. Understanding Cost Management: What Can We Learn from the Evidence on 'Sticky Costs'?. Working Paper. https://doi.org/10.2139/ssrn.975135

Atiase, Rowland Kwame. 1985. Predisclosure Information, Firm Capitalization, and Security Price Behavior Around Earnings Announcements. *Journal of Accounting Research* 23 (1): 21－36. https://doi.org/10.2307/2490905

Balakrishnan, Ramji, Michael J. Petersen, and Naomi S. Soderstrom. 2004. Does Capacity Utilization Affect the "Stickiness" of Cost? *Journal of Accounting, Auditing & Finance* 19 (3): 283－299. https://doi.org/10.1177/0148558x0401900303

Balakrishnan, R., E. Labro, and N. S. Soderstrom. 2014. Cost Structure and Sticky Costs. *Journal of Management Accounting Research* 26 (2): 91－116. https://doi.org/10.2308/jmar-50831

Banker, Rajiv D., and Dmitri Byzalov. 2014. Asymmetric Cost Behavior. *Journal of Management Accounting Research* 26 (2): 43－79. https://doi.org/10.2308/jmar-50846

Banker, Rajiv D., Janice Chen, and Han-Up Park. 2017. Cost behavior models analysts and investors use. Working paper. https://doi.org/10.2139/ssrn.2482723

Banker, Rajiv D., and Lei Chen. 2006. Predicting Earnings Using a Model Based on Cost Variability and Cost Stickiness. *The Accounting Review* 81 (2): 285－307. https://doi.org/10.2308/accr.2006.81.2.285

Banker, Rajiv D., H. U. Park, and X. Zhong. 2016. The source of persistence in analysts' relative forecast accuracy. Working Paper.

Barron, Orie E., Oliver Kim, Steve C. Lim, and Douglas E. Stevens. 1998. Using Analysts'

Forecasts to Measure Properties of Analysts' Information Environment. *The Accounting Review* 73 (4): 421－433.

Barron, Orie E., Donal Byard, and Oliver Kim. 2002. Changes in Analysts' Information around Earnings Announcements. *The Accounting Review* 77 (4): 821－846. https://doi.org/10.2308/accr.2002.77.4.821

Barron, Orie E., David G. Harris, and Mary Stanford. 2005. Evidence That Investors Trade on Private Event－Period Information around Earnings Announcements. *The Accounting Review* 80 (2): 403－421. https://doi.org/10.2308/accr.2005.80.2.403

Barron, Orie E., Mary Harris Stanford, and Yong Yu. 2009. Further Evidence on the Relation between Analysts' Forecast Dispersion and Stock Returns. *Contemporary Accounting Research* 26 (2): 329－357. https://doi.org/10.1506/car.26.2.1

Barron, Orie E., Donal Byard, and Yong Yu. 2008. Earnings Surprises That Motivate Analysts to Reduce Average Forecast Error. *The Accounting Review* 83 (2): 303－325. https://doi.org/10.2308/accr.2008.83.2.303

Bartov, Eli, Dan Givoly, and Carla Hayn. 2002. The Rewards to Meeting or Beating Earnings Expectations. *Journal of Accounting and Economics* 33 (2): 173－204. https://doi.org/10.1016/S0165-4101(02)00045-9

Basu, Sudipta. 1997. The Conservatism Principle and the Asymmetric Timeliness of Earnings. *Journal of Accounting and Economics* 24 (1): 3－37. https://doi.org/10.1016/S0165-4101(97)00014-1

Bhushan, Ravi. 1989. Firm characteristics and analyst following. *Journal of Accounting and Economics* 11 (2): 255－274. https://doi.org/10.1016/0165-4101(89)90008-6

Botosan, Christine A., Marlene A. Plumlee, and Yuan Xie. 2004. The Role of Information Precision in Determining the Cost of Equity Capital. *Review of Accounting Studies* 9 (2): 233－259. https://doi.org/10.1023/B:RAST.0000028188.71604.0a

Bowen, Robert M., Angela K. Davis, and Dawn A. Matsumoto. 2002. Do Conference Calls Affect Analysts' Forecasts? *The Accounting Review* 77 (2): 285－316. https://doi.org/10.2308/accr.2002.77.2.285

Brown, Lawrence D., Gordon D. Richardson, and Steven J. Schwager. 1987. An Information Interpretation of Financial Analyst Superiority in Forecasting Earnings. *Journal of Accounting Research* 25 (1): 49－67. https://doi.org/10.2307/2491258

Brown, Lawrence D. 2001. A Temporal Analysis of Earnings Surprises: Profits versus Losses. *Journal of Accounting Research* 39 (2): 221－241. https://doi.org/10.1111/1475-679X.00010

Bugeja, Martin, Meiting Lu, and Yawen Shan. 2015. Cost Stickiness in Australia:

Characteristics and Determinants. *Australian Accounting Review* 25 (3): 248－261. https://doi.org/10.1111/auar.12066

Byard, Donal A. 1998. Cross-sectional and Time-series Patterns in Pre-announcement Information Inferred from Analysts' Forecasts. Ph.D. diss., University of Maryland.

Byard, Donal, and Kenneth W. Shaw. 2003. Corporate Disclosure Quality and Properties of Analysts' Information Environment. *Journal of Accounting, Auditing & Finance* 18 (3): 355－378. https://doi.org/10.1177/0148558x0301800304

Byard, Donal, Ying Li, and Yong Yu. 2011. The Effect of Mandatory IFRS Adoption on Financial Analysts' Information Environment. *Journal of Accounting Research* 49 (1): 69－96. https://doi.org/10.1111/j.1475-679X.2010.00390.x

Calleja, Kenneth, M. Steliaros, and Dylan C. Thomas. 2006. A note on cost stickiness: Some international comparisons, *Management Accounting Research* 17 (2): 127－140. https://doi.org/10.1016/j.mar.2006.02.001

Chen, Sjuping, and Dawn A. Matsumoto. 2006. Favorable versus Unfavorable Recommendations: The Impact on Analyst Access to Management-Provided Information. *Journal of Accounting Research* 44 (4): 657－689. https://doi.org/10.1111/j.1475-679X.2006.00217.x

Ciftci, M., and F. M. Salama. 2018. Stickiness in Costs and Voluntary Disclosures: Evidence from Management Earnings Forecasts. *Journal of Management Accounting Research* 30 (3): 211－234. https://doi.org/10.2308/jmar-51966

Clement, Michael B. 1999. Analyst Forecast Accuracy: Do Ability, Resources, and Portfolio Complexity Matter? *Journal of Accounting and Economics* 27 (3): 285－303. https://doi.org/10.1016/S0165-4101(99)00013-0

Collins, Daniel W., S. P. Kothari, and Judy Dawson Rayburn. 1987. Firm Size and the Information Content of Prices with Respect to Earnings. *Journal of Accounting and Economics* 9 (2): 111－138. https://doi.org/10.1016/0165-4101(87)90002-4

Duru, Augustine, and David M. Reeb. 2002. International Diversification and Analysts' Forecast Accuracy and Bias. *The Accounting Review* 77 (2): 415－433. https://doi.org/10.2308/accr.2002.77.2.415

Easley, David, and Maureen O' hara. 2004. Information and the Cost of Capital. *The Journal of Finance* 59 (4): 1553－1583. https://doi.org/10.1111/j.1540-6261.2004.00672.x

Eddy, Albert, and Bruce Seifert. 1992. An Examination of Hypotheses Concerning Earnings Forecast Errors. *Quarterly Journal of Business & Economics* 31 (2): 22－37.

Francis, Jennifer, Dhananjay Nanda, and P. E. R. Olsson. 2008. Voluntary Disclosure, Earnings Quality, and Cost of Capital. *Journal of accounting research* 46 (1): 53－99. https://doi.org/10.1111/j.1475-679X.2008.00267.x

Freeman, Robert N., and Senyo Y. Tse. 1992. A Nonlinear Model of Security Price Responses to Unexpected Earnings. *Journal of Accounting Research* 30 (2): 185－209. https://doi.org/10.2307/2491123

Garrison, Ray. H., Eric W. Noreen, and Peter C. Brewer. 2017. *Managerial Accounting*. 16th edition. New York, NY: McGraw-Hill.

Gu, Zhaoyang, and Ting Chen. 2004. Analysts' Treatment of Nonrecurring Items in Street Earnings. *Journal of Accounting and Economics* 38 (1－3): 129－170. https://doi.org/10.1016/j.jacceco.2004.09.002

Harris, Milton, and Artur Raviv. 1993. Differences of Opinion Make a Horse Race. *The Review of Financial Studies* 6 (3): 473－506.

Holthausen, Robert W., and Robert E. Verrecchia. 1990. The Effect of Informedness and Consensus on Price and Volume Behavior. *The Accounting Review* 65 (1): 191－208.

Homburg, Carsten, and Julia Nasev. 2008. How Timely Are Earnings When Costs Are Sticky? Implications for the Link between Conditional Conservatism and Cost Stickiness. Paper presented at the AAA 2009 Management Accounting Section. https://doi.org/10.2139/ssrn.1187082

Indjejikian, Raffi J. 1991. The Impact of Costly Information Interpretation on Firm Disclosure Decisions. *Journal of Accounting Research* 29 (2): 277－301. https://doi.org/10.2307/2491050

Ke, Bin, and Yong Yu. 2006. The Effect of Issuing Biased Earnings Forecasts on Analysts' Access to Management and Survival. *Journal of Accounting Research* 44 (5): 965－999. https://doi.org/10.1111/j.1475-679X.2006.00221.x

Kim, Myungsun, and Jenice Prather-Kinsey. An Additional Source of Financial Analysts' Earnings Forecast Errors: Imperfect Adjustments for Cost Behavior. *Journal of Accounting, Auditing & Finance* 25 (1): 27－51. https://doi.org/10.1177/0148558X1002500102

Kim, Oliver, and Robert E. Verrecchia. 1991. Trading Volume and Price Reactions to Public Announcements. *Journal of Accounting Research* 29 (2): 302－21. https://doi.org/10.2307/2491051

Kim, Oliver, and Robert E. Verrecchia. 1994. Market Liquidity and Volume around Earnings Announcements. *Journal of Accounting and Economics* 17 (1): 41－67.

https://doi.org/10.1016/0165-4101(94)90004-3
Kim, Oliver, and Robert E. Verrecchia. 1997. Pre-announcement and Event-period Private Information. *Journal of Accounting and Economics* 24 (3): 395-419. https://doi.org/10.1016/S0165-4101(98)00013-5
Lang, Mark H., and Russell J. Lundholm. 1996. Corporate Disclosure Policy and Analyst Behavior. *The Accounting Review* 71 (4): 467-492.
McNichols, Maureen, and Patricia C. O' Brien. 1997. Self-Selection and Analyst Coverage. *Journal of Accounting Research* 35: 167-199. https://doi.org/10.2307/2491460
Mest, David P., and Elizabeth Plummer. 2000. Revisions in Analysts' Earnings Forecasts: Evidence of Non-linear Adaptive Expectations. *Journal of Forecasting* 19 (6): 467-484. https://doi.org/10.1002/1099-131X(200011)19:6<467::AID-FOR760>3.0.CO;2-A
Mikhail, Michael B., Beverly R. Walther, and Richard H. Willis. 1999. Does Forecast Accuracy Matter to Security Analysts? *The Accounting Review* 74 (2): 185-200. https://doi.org/10.2308/accr.1999.74.2.185
Miller, Gregory S. 2002. Earnings Performance and Discretionary Disclosure. *Journal of Accounting Research* 40 (1): 173-204. https://doi.org/doi:10.1111/1475-679X.00043
Noreen, E., and N. Soderstrom. 1997. The Accuracy of Proportional Cost Models: Evidence from Hospital Service Departments. *Review of Accounting Studies* 2: 89-114. https://doi.org/10.1023/a:1018325711417
Penman, Stephen H. 1991. An Evaluation of Accounting Rate-of-return. *Journal of Accounting, Auditing & Finance* 6 (2): 233-255. https://doi.org/10.1177/0148558x9100600204
Richardson, Scott, Siew Hong Teoh, and Peter D. Wysocki. 2004. The Walk-down to Beatable Analyst Forecasts: The Role of Equity Issuance and Insider Trading Incentives. *Contemporary Accounting Research* 21 (4): 885-924. https://doi.org/10.1506/KHNW-PJYL-ADUB-0RP6
Skinner, Douglas J., and Richard G. Sloan. 2002. Earnings Surprises, Growth Expectations, and Stock Returns or Don't Let an Earnings Torpedo Sink Your Portfolio. *Review of Accounting Studies* 7 (2): 289-312. https://doi.org/10.1023/a:1020294523516
Stickel, Scott E. 1989. The Timing of and Incentives for Annual Earnings Forecasts Near Interim Earnings Announcements. *Journal of Accounting and Economics* 11 (2-3): 275-292. https://doi.org/10.1016/0165-4101(89)90009-8
Stickel, Scott E. 1992. Reputation and Performance Among Security Analysts. *The Journal of Finance* 47 (5): 1811-1836. https://doi.org/10.2307/2328997
Soltes, Eugene. 2014. Private Interaction Between Firm Management and Sell-Side

Analysts. *Journal of Accounting Research* 52 (1): 245－272. https://doi.org/10.1111/1475-679X.12037

Subramaniam, Chandra, and M. W. Watson. 2016. Additional Evidence on the Sticky Behavior of Costs. *In Advances in Management Accounting*. Emerald Group Publishing Limited: 275－305.

Watts, Ross L., and Jerold L. Zimmerman. 1986. *Positive Accounting Theory.* N.J.: Prentice-Hall.

Waymire, Gregory. 1985. Earnings Volatility and Voluntary Management Forecast Disclosure. *Journal of Accounting Research* 23 (1): 268－295. https://doi.org/10.2307/2490919

Weiss, Dan, Prasad A. Naik, and Chih-Ling Tsai. 2008. Extracting Forward-Looking Information from Security Prices: A New Approach. *The Accounting Review* 83 (4): 1101－1124. https://doi.org/10.2308/accr.2008.83.4.1101

Weiss, Dan. 2010. Cost Behavior and Analysts' Earnings Forecasts. *The Accounting Review* 85 (4): 1441－1471. https://doi.org/10.2308/accr.2010.85.4.1441